Second NUS Workshop on Risk & Regulation (R^2 Workshop)

9-10 January 2014
National University of Singapore

ORGANIZED BY:

NUS — National University of Singapore | Centre for Quantitative Finance Faculty of Science

Table of Contents

PROGRAMME
Overview | Daily Schedule

PROGRAMME OVERVIEW

THURSDAY 9 January 2014	FRIDAY 10 January 2014
08:30 – 08:50 Registration	**08:30 – 09:00** Registration
08:50 – 09:00 Opening Address	
09:00 – 09:50 (IS) Shaji CHANDRASENAN	**09:00 – 09:50** (IS) Dilip MADAN
09:50 – 10:20 Group Photo & Tea Break	**09:50 – 10:20** Tea Break
10:20 – 11:10 (IS) David SCHMEIDLER	**10:20 – 11:10** (IS) Min DAI
11:10 – 12:00 (IS) Steven KOU	**11:10 – 12:00** (IS) Xianhua PENG
12:00 – 14:00 Lunch	**12:00 – 14:00** Lunch
14:00 – 14:50 (IS) Jussi KEPPO	**14:00 – 14:50** (IS) Melvyn SIM
14:50 – 15:40 (IS) Jochen THEIS	**14:50 – 15:40** (IS) Max WONG
15:40 – 16:00 Tea Break	**15:40 – 16:00** Tea Break
16:00 – 16:20 (CS) Boguslaw Jan BLAWAT	**16:00 – 16:20** (CS) Argus SUN
16:20 – 16:40 (CS) Sang HU	**16:20 – 16:40** (CS) Marco MARCHIORO

PROGRAMME OVERVIEW

THURSDAY 9 January 2014	FRIDAY 10 January 2014
16:40 – 17:00 (CS) Bo LI	**16:40 – 16:50** Closing Address

☐ Invited Talks   ☐ Contributed Talks

Lecture theatre is equipped with desktop computer connected to LCD projector, projector screen, visualizer, overhead projector, white board, and separate connection for personal notebook/laptop. Microphone will be provided.

Thursday, 9 January 2014

TIME	ACTIVITY	VENUE	REF
08:30 – 08:50	Registration	LT 34 foyer	--
08:50 – 09:00	**Opening Address**	LT 34	--
Invited Talk			
09:00 – 09:50	**Shaji CHANDRASENAN** Monetary Authority of Singapore, Singapore *New Trading Book Rules: MAS's Views*	LT 34	Pg 1
09:50 – 10:20	Group Photo & Tea Break	LT 34 foyer	--
10:20 – 11:10	**David SCHMEIDLER** Tel Aviv University, Israel *No-Betting-Pareto Dominance*	LT 34	Pg 2
11:10 – 12:00	**Steven KOU** National University of Singapore, Singapore *Measurement of Economic Tail Risk*	LT 34	Pg 2
12:00 – 14:00	Lunch	LT 34 foyer	--
14:00 – 14:50	**Jussi KEPPO** National University of Singapore, Singapore *Under Cover Risk-taking - The Volcker Rule, Creative Compliance, and its Preliminary Effects*	LT 34	Pg 1
14:50 – 15:40	**Jochen THEIS** Standard Chartered Bank, Singapore *Quantitative Challenges from Recent and Emerging Regulation*	LT 34	Pg 3
15:40 – 16:00	Tea Break	LT 34 foyer	--
Contributed Talk			
16:00 – 16:20	**Boguslaw Jan BLAWAT** Risk Management Institute, Singapore *News Analysis and Risk Management*	LT 34	Pg 6
16:20 – 16:40	**Sang HU** The Chinese University of Honk Kong, Hong Kong *Casino Gambles and Randomization*	LT 34	Pg 6
16:40 – 17:00	**Bo LI** National University of Singapore, Singapore *Adaptive Functional Autoregressive Modelling for Stationary and Non-stationary Functional Data*	LT 34	Pg 7

FRIDAY, 10 January 2014

TIME	ACTIVITY	VENUE	PAGE
08:30 – 09:00	Registration	LT 34 foyer	--
Invited Talk			
09:00 – 09:50	**Dilip MADAN** University of Maryland, USA *Risk and Regulation in Two Price Economies*	LT 34	Pg 2
09:50 – 10:20	Tea Break	LT 34 foyer	--
10:20 – 11:10	**Min DAI** National University of Singapore, Singapore *Portfolio Choice with Market Closure and Implications for Liquidity Premia*	LT 34	Pg 1
11:10 – 12:00	**Xianhua PENG** Hong Kong University of Science and Technology, Hong Kong *Location, Location, Location: Econometric Analysis of Asset Pricing with Spatial Interaction*	LT 34	Pg 5
12:00 – 14:00	Lunch	LT 34 foyer	--
14:00 – 14:50	**Melvyn SIM** National University of Singapore, Singapore *Managing Operations to Meet Consumption Targets*	LT 34	Pg 3
14:50 – 15:40	**Max WONG** Royal Bank of Scotland, Singapore *Exploring the use of Kelly Criterion for Basel Capital Requirement – Optimal and Countercyclical?*	LT 34	Pg 4
15:40 – 16:00	Tea Break	LT 34 foyer	--
Contributed Talk			
16:00 – 16:20	**Argus SUN** UCLA School of Engineering and Applied Science, USA *Stochastic Simulation for Analysing Risk in a Biomedical Time Series*	LT 34	Pg 8
16:20 – 16:40	**Marco MARCHIORO** Quant Island, Singapore *Risk Contributions in Simulations of Commodity Derivatives*	LT 34	Pg 8
16:40 – 16:50	**Closing Address**	LT 34	--

ABSTRACTS
Invited Talks

New Trading Book Rules: MAS's Views
Shaji CHANDRASENAN, Monetary Authority of Singapore, Singapore

The Basel Committee on banking supervision's working group on Trading Book had released their second consultative paper in Oct 2013. It highlights several new features like 'Regulatory Desks' etc. The session will touch on how MAS might implement the new rules.

Portfolio Choice with Market Closure and Implications for Liquidity Premia
Min DAI, National University of Singapore, Singapore

Most existing portfolio choice models ignore the prevalent periodic market closure and the fact that market volatility is significantly higher during trading periods. We find that market closure and the volatility difference across trading and nontrading periods significantly change optimal trading strategies. In addition, we show that transaction costs can have a first order effect on liquidity premia that is largely comparable to empirical findings.

Moreover, the higher liquidity premium is not from higher trading frequency, but mainly from the substantially "suboptimal" trading strategy. In supportive of the importance of the volatility difference across trading and nontrading periods, our empirical analysis finds that the greater this difference the higher the liquidity premia.

This is a joint work with Peifan LI, Hong LI, and Yajun WANG.

Under Cover Risk-taking - The Volcker Rule, Creative Compliance, and its Preliminary Effects
Jussi KEPPO, National University of Singapore, Singapore

We analyze Volcker Rule's preliminary effects on US bank holding companies by using accounting, regulatory and market data. We find that the bank holding companies that are most affected by the Volcker Rule reduce their trading books stronger than other bank holding companies. However, we do not find corresponding effects in risk-taking - if anything, affected banks seem to have more risks and they use less hedging. These findings imply that the Volcker Rule has so far not led to its intended consequences.

This is a joint work with Josef KORTE.

Risk and Regulation in Two Price Economies
Dilip MADAN, University of Maryland, USA

Two price economies arise when market clearing fails leaving the market exposed to residual risk. Financial market valuation operators in such economies, in the absence of arbitrage, turn out to be nonlinear martingales. The new nonlinear valuation methodology leads, in particular, to new approaches for designing portfolios, constructing hedges, investing in options, defining risk sensitive capital, while simultaneously providing new insights into the management of corporate entities and for the financial accounting of economic activity.

Measurement of Economic Tail Risk
Steven KOU, National University of Singapore, Singapore

We provide an utility/decision theoretical foundation for the measurement of economic tail risk. Risk measurement is not only closely related to utility theory, but also relevant to elicitability of statistical functionals in face of statistical model uncertainty. The main result of the paper is that the only tail risk measure that satisfies a set of economic axioms proposed by Schmeidler (1989, Econometrica) and the statistical property of elicitability (i.e. there exists an objective function such that minimizing the expected objective function elicits the risk measure) is the median shortfall, which is the median of the tail loss distribution and is also the VaR at a higher confidence level. As an application, we demonstrate that the median shortfall is a better alternative than the expected shortfall as a risk measure for setting capital requirements in Basel Accords.

This is a joint work with Xianhua PENG.

No-Betting-Pareto Dominance
David SCHMEIDLER, Tel Aviv University, Israel

We argue that the notion of Pareto dominance is not as compelling in the presence of uncertainty as it is under certainty. In particular, voluntary trade based on differences in tastes is commonly accepted as desirable, because tastes cannot be wrong. By contrast, voluntary trade based on incompatible beliefs may indicate that at least one agent entertains mistaken beliefs. We propose and characterize a weaker, No-Betting, notion of Pareto domination which requires, on top of unanimity of preference, the existence of shared beliefs that can rationalize such preference for each agent.

This is a joint work with Itzhak GILBOA and Larry SAMUELSON.

Managing Operations to Meet Consumption Targets
Melvyn SIM, National University of Singapore, Singapore

We study dynamic operational decision problems of a firm where risky cash flows are being resolved over a finite planning horizon. The firm can finance consumptions by borrowing or saving to attain some prescribed consumption targets over time. To evaluate the ability of these consumptions in meeting respective targets, we propose the Consumption Shortfall Risk (CSR) criterion, that has salient properties of attainment content, starvation aversion, subadditivity and positive homogeneity. We show that if borrowing and saving are unrestricted and their interest rates are common, the optimal policy that minimizes the CSR criterion is to finance consumptions at the target levels for all periods except the last. For general convex dynamic decision problems, the optimal policies correspond to those that maximize an additive expected utility. Through the choice of targets, we propose an algorithm to determine the weights and parameters of the utility functions. We also analyze the optimal policies of joint inventory-pricing decision problems under the target-oriented criterion and provide optimal policy structures. With a numerical study for inventory control problems, we report favorable computational results for using targets in regulating uncertain consumptions over time.

This is a joint work with Lucy Chen (NUS) and Zhuoyu Long (CUHK).

Quantitative Challenges from Recent and Emerging Regulation
Jochen THEIS, Standard Chartered Bank, Singapore

Briefly, the Fundamental Review of the Trading Book and related exercises by the Basel Committee and other regulators are aiming to systematically revise the regulatory framework. The proposed changes pose various quantitative challenges, which I will discuss briefly. I will also touch upon some other recent regulations presenting quantitative challenges, notably the draft Regulatory Technical Standards by the EBA on prudent valuation.

Exploring the use of Kelly Criterion for Basel Capital Requirement – Optimal and Countercyclical?

Max C. Y. WONG, Royal Bank of Scotland, Singapore

The Basel capital is a "margin" requirement imposed by regulators to cushion banks against extreme falls in prices of assets held on its balance sheets, especially during financial crises. The formula is often a function of tail risk measures such as value-at-risk (VaR). To satisfy this regulation, the way banks rebalance their balance sheets throughout a boom-bust cycle is akin to leverage targeting. After the 2008 crisis it was recognized that this rebalancing behaviour will cause a margin spiral in the markets and systemic risk. The crisis revealed that Basel II capital was too low to protect banks against crisis losses, but the industry believes the current Basel III capital requirements are too high for sustainable business. Is there an optimal capital?

The insight is that balance sheet rebalancing with a target leverage can be described by a multiplicative game or process. In such a game, most players will lose money even if the game has a positive edge. The reason is suboptimal or excessive leverage causes many players to get wiped out over time and the system achieves a "winner takes all" effect. Fortunately, the Kelly criterion provides an optimal leverage that could mitigate this curse of leverage. Treating a bank as a player in this multiplicative process and using balance sheet simulation, this article shows that the Basel's capital is suboptimal and the Kelly criterion gives a capital which allows the fastest equity growth. The article suggests how this can be computed in practice for an actual bank to improve its profitability and avoid the risk of ruin.

While a risk-based capital is inherently procyclical, we found that a Kelly-based capital could potentially be countercyclical, and could reinforce the central bank's monetary policy transmission mechanism.

Keywords: Kelly criterion, optimal leverage, countercyclical capital, balance sheet simulation, capital adequacy, systemic risk, procyclical risk, value at risk

JEL classification: C15, G01, G11, G18, G20, G28, G32, G38

Location, Location, Location: Econometric Analysis of Asset Pricing with Spatial Interaction

Location, Location, Location: Econometric Analysis of Asset Pricing with Spatial Interaction

Xianhua PENG, Hong Kong University of Science and Technology, Hong Kong

Spatial interaction is well-known to be important in modeling real estate assets, as housing prices are significantly affected by neighborhood prices. Although spatial econometrics has been applied to empirical studies of housing markets, there is as yet little theoretical work that studies the risk and return of real estate securities. We attempt to fill this gap by proposing a spatial capital asset pricing model (S-CAPM) and a spatial arbitrage pricing theory (S-APT) that extend the classical asset pricing models by incorporating spatial interaction among asset returns. Furthermore, we give rigorous econometric analysis of the models by deriving identifiability conditions for the parameters and asymptotic properties of estimators and studying test statistics needed for implementing the models. Finally, an empirical study of the futures contracts on S&P/Case-Shiller Home Price Indices shows that the S-APT is not rejected and the spatial interaction parameter is statistically significant.

ABSTRACTS
Contributed Talks

News Analysis and Risk Management
Boguslaw Jan BLAWAT, Risk Management Institute, Singapore

The use of news data within risk forecasting can allow for dynamic (adaptive) risk management strategies that are forward-looking and are based on changing market environments. Risk analysis using news data can help investors understand event risk and how different kinds of events can impact their portfolio risk profile.

The risk structure of assets may change over time in response to news. The systematic risk (beta) of stocks increases in response to firm-specific news (in the form of earnings announcements). Further, much of the beta increase arises from an increase in covariance with other stocks. This suggests there could be a contagion effect in the information releases for one stock on the price movements of other stocks. They suggest the Credit Crisis (2008) could be viewed as a negative earnings surprise for the market.

By implementing news variables related to the macroeconomic sentiment of the US Market and additional variables related to the firm specific news into existing NUS-RMI Credit Research Initiative model I have found support for the hypothesis that news sentiment can forecast default events.

Casino Gambles and Randomization
Sang HU, The Chinese University of Hong Kong, Hong Kong

We find that when external randomization is introduced into the gambling process, the optimal gambling value is better than before. We know such a randomization is necessary to embed many centered probability distributions in the random walk. Given the probability distribution, we want to recover the stopping time τ that can be embedded in the simple symmetric random walk. If we consider the stopping times with respect to natural filtration, there always exists a stopping time τ such that S_τ has the same given probability distribution.   However, $(S_{n \wedge \tau} : n \geq 0)$ may not be uniformly integrable through some trivial embedding. We consider the stopping time with respect to an enlarged filtration by adding some independent randomization to $\sigma(S_n : n \geq 0)$ so that $(S_{n \wedge \tau} : n \geq 0)$ is uniformly integrable through embedding of full randomization or path-dependent Azema-Yor-like stopping times.

Authors: Sang HU and Xun Yu ZHOU, Department of Systems Engineering and Engineering Management, The Chinese University of Hong Kong, Hong Kong; Jan OBLOJ, Mathematics Institute, University of Oxford, UK

Adaptive Functional Autoregressive Modeling for Stationary and Non-Stationary Functional Data
Bo LI, National University of Singapore, Singapore

Our proposed adaptive functional autoregressive (AFAR) modeling has time varying operators that allow it to be safely used in both stationary and non-stationary situations. Under stationarity, we develop a consistent maximum likelihood (ML) estimator with closed form, and the likelihood function is defined on the parameters' subspace or Sieves. For non-stationary data, the estimation is conducted over an interval of local homogeneity, over which the time-varying data generating process can be approximated by a functional autoregressive (FAR) model with constant parameters. The local interval is identified in a sequential testing procedure. Simulation study illustrates finite sample properties of the proposed AFAR modeling. Real data application on forecasting California electricity daily price curves demonstrates a superior accuracy of the proposed AFAR modeling compared to several alternatives.

Keywords: Forecast electricity price curves; functional autoregressive model; local homogeneity; non-stationary time series.

Authors: Ying CHEN and Bo LI, Department of Statistics and Applied Probability, National University of Singapore, Singapore

Risk Contributions in Simulations of Commodity Derivatives
Marco MARCHIORO, Quant Island, Singapore

It is well-known fact the importance of commodities as an asset class alternative to equities and bonds. Since more and more commodity-based derivatives are traded in the financial markets. It is important to be able to properly compute the risk for these products. We review the importance of convenience yield in commodity-derivative pricing and describe how to compute risk simulations for commodity futures and futures spreads. We then devise and ad-hoc procedure to compute the components of risk due to different variables such as the underlying commodity price, interest rates, and the convenience yield. We conclude by showing some numerical results that highlight the importance of convenience yield in computing risk of commodity derivatives.

Keywords: Risk management, risk contributions, and commodity derivatives

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Stochastic Simulation for Analyzing Risk in a Biomedical Time Series
Argus SUN, UCLA School of Engineering and Applied Science, USA

Risk in the biomedical, biotechnology and pharmaceutical fields are increasingly being addressed using computational methods. Important risk categories include risk from changes in regulation and credit risk among others. Typically computational methods for VaR calculation rely heavily (85%) on historical simulation to fit distributions, while only 15% use pure Monte Carlo simulation. Without doubt, stochastic simulation has an advantage over deterministic simulation when data being modeled has size limitations. Here we examine the AIM94 Diabetes dataset, a classic biomedical time series, to elucidate risks. Two methods used are autoregression and geometric Brownian motion. First-order autoregression uses four parameters, μ, mean; σ, volatility; Y_o, initial value; a_1 autoregression coefficient in the following equations:

(1) $\varepsilon_t = \sigma N_t$

(2) $(Y_t - \mu) = a_1(Y_t\text{-}1 - \mu) + \varepsilon_t$

Where N_t is a sample from the normal distribution. The alternative computational method, Brownian Motion uses μ and σ as the location and volatility parameters respectively as follows:

(3) $Y_{t+T} = Y_t e^{\left[\left(\frac{\mu - \sigma^2}{2}\right)T + N_{t+T}\sigma\sqrt{T}\right]}$ for any t ≥ 0, T > 0

Using these two types of stochastic simulation, the time series data is modeled to reveal risks found in the trends.

INFORMATION
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Committee

ORGANIZING COMMITTEE

Min DAI (National University of Singapore, Singapore)

Jussi KEPPO (National University of Singapore, Singapore)

Steven KOU (National University of Singapore, Singapore)

Logistics

LECTURE VENUES

All talks will take place in Lecture Theatre 34 (level 3, block S17). The duration for each invited talk is 50 minutes, and the duration for each contributed talk is 20 minutes (including discussion time).

The lecture theatres are equipped with desktop computer connected to LCD projector, projector screen, visualizer, overhead projector, white board, and separate connection for personal notebook/laptop.

MEALS

Tea breaks and lunches, served buffet-style at the foyer of the lecture theatre, are catered from a Halal-certified supplier. Usually some of the food items would be suitable for vegetarians.

Dinners are not included. Nevertheless, a wide variety of food at affordable prices (from S$2.00) is available in the non-air-conditioned canteen and air-conditioned cafe near the venue for talks. More canteens, fast food outlets and restaurants are found in other parts of the campus (refer to Zonal Map). Some are less than 10-minutes' walk away from the conference venue while some are accessible by internal shuttle bus. Some stalls may open as early as 7.30am and close as late as 8.00pm. Halal and Vegetarian options are available in all canteens on campus.

LIBRARIES

There are seven multi-disciplinary and special libraries in NUS. The Central Library, for instance, is a multi-disciplinary library with a collection that covers architecture, building and real estate, engineering & technology, arts, humanities and social sciences. The Science Library is a special library that holds collections covering primarily the biological sciences, chemistry, computer science, mathematics, statistics & applied probability, materials science and physics. The Science/Medical Library is located on levels 3 to 6, block S6. All libraries are controlled by smart-card access but a special arrangement has been made to allow workshop participants to enter the libraries during the workshop period.

Kindly approach library staff for registration using your name tag and NRIC/passport number before entering the library. Participants may browse/read the materials in the library without loan privileges.

Operating hours of the libraries during workshop period:

Science/Medical/Central Libraries:	8.30am – 7.00pm (Monday – Friday)
	10.00am – 5.00pm (Saturday)
Hon Sui Sen Memorial Library:	8.30am – 6.00pm (Monday – Friday)
	10.00am – 5.00pm (Saturday)
Music Library:	8.30am – 6.00pm (Monday – Friday)

INTERNET ACCESS & USE OF COMPUTERS

A computing lab (S17-03-02) will be open for participants' access during the event period. It is located at level 3 of block S17 and consists of 42 desktop units that are internet-ready and installed with Windows 7, standard Microsoft Office applications, SSH, Adobe Reader, MATLAB. Limited WI-FI accounts would also be made available during event period for the convenience of those using personal notebook/laptop.

Operating hours: 8.30am – 6.00pm (Wednesday – Thursday)
                               8.30am – 5.30pm (Friday)

Participants will have to request for account name and password to use either the computer in the computing lab, or for WI-FI access on their own notebook/laptop. Approach the IT support staff for account name and password (subject to availability).

FAX SERVICE

Participants who wish to send faxes may do so at the general office of the Department of Mathematics (level 4, block S17). This service is chargeable at a flat rate of S$0.50 per page.

Operating hours: 8.30am – 6.00pm (Monday – Thursday)
                               8.30am – 5.30pm (Friday)

GETTING AROUND NUS

The internal shuttle buses A, B, C, D, and UT-FoS (free-of-charge) serve the Kent Ridge campus.

Bus A1 and A2 cover substantial parts of the campus. A1 stops outside Kent Ridge MRT station, near NUH Staff Canteen and opposite S17 while A2 stops outside S17, opposite NUH Staff Canteen and opposite Kent Ridge MRT station. Bus A1E and A2E operates during term time on weekdays except public holidays. Bus A1E operates from 7.30am to 9.00am and stops outside Kent Ridge MRT station, and opposite S17. Bus A2E operates from 5.30pm to 7.00pm and stops outside S17, and opposite Kent Ridge MRT station.

Bus B is a loop service that serves Kent Vale and the other part of the campus. It does not stop at or anywhere near S17.

Bus C is a loop service that serves Kent Vale. It stops in front of and opposite S17.

Bus D is a loop service that serves the University Town. Bus D2 stops outside Kent Ridge MRT, opposite S17, University Town, outside S17 and opposite Kent Ridge MRT.

Bus UT-FoS is a direct service provided during term time on weekdays except public holiday at 9.40am, 9.50am, 11.40am, 11.50am, 1.40pm, 1.50pm, 3.40pm, and 3.50pm. Bus UT-FoS stops only at University Town and opposite S17.

More details on NUS internal shuttle bus can be found at:
http://www.nus.edu.sg/oed/services/transport/shuttle-bus-services.htm

The public bus SBS95 stops at the same stops as A1 and A2 between S17 and Kent Ridge MRT station. It also stops near and opposite Buona Vista MRT station (which is off-campus).

General

PUBLIC TRANSPORTATION

The public transport network in Singapore consists of bus, MRT (Mass Rapid Transit), LRT (Light Rail Transit) and taxi. Buses and MRTs are the most affordable modes of public transport with standard fares ranging from S$1.00 to S$2.20 (depending on distance). Bus fares are charged on board by tapping a stored-value card or paying the exact fare in Singapore currency to the driver.

MRT fare is paid by tapping a Stored Value Card or a Standard Ticket at the gantry. The Standard Ticket can be used up to six times within 30 days from the date of purchase. The purchase price includes a deposit of 10 cents and this is automatically refunded on the travel fare of the third trip. A user also enjoys a 10-cent discount on the sixth trip. The Standard Ticket can be purchased at the General Ticketing Machine (GTM) at all MRT and LRT stations. LRTs are only available in selected residential neighborhoods and operate similarly as MRTs.

Typically, the first bus and train starts running at 5.30am and the last service is 11.30pm daily. Special night bus services with specific routes that charge a flat rate of S$3.00/S$3.50 are available from 11.30pm to 4.30am on Fridays, Saturdays and eves of Public Holidays.

Taxis can be flagged down 24 hours a day on most roads or at taxi-stands outside most major shopping centers and hotels. There is no need to bargain for prices as the taxis are all metered. The basic fare consists of a flag-down fare and a metered fare. The flag-down fare for the first kilometer is between S$3.00 and S$5.00, depending on the type of taxi (regular or premium). The metered fare after the first kilometer is based on the distance and waiting times during the journey. Additional charges may also be incurred depending on the time of travel and origin of the journey. A detailed rates guide is posted on the rear door of each taxi for reference.

More information on public transport can be found at:
(www.publictransport.sg/content/publictransport/en/homepage/CommutersGuide.html).

GETTING TO THE AIRPORT

The easiest way to get to the airport is by taxi. For reference, the journey from NUS with smooth traffic would take about 30 minutes and cost about S$25.00 without surcharge. Surcharges may be incurred depending on time of travel and if the taxi was pre-booked via phone.

To get to the airport by MRT (Mass Rapid Transit), connect to the East-West line (green line) going in the direction of Pasir Ris/Changi Airport. The Changi Airport MRT station is located under Terminals 2 and 3 which are connected to Terminal 1 by sky train. A one-way MRT fare from Kent Ridge station is about S$2.30 (using the Standard Ticket) and takes approximately 57 minutes. More Information on MRT Network Map and fare can be found at:
http://www.smrt.com.sg/Trains/NetworkMap.aspx

FOOD & SHOPPING

Food centers and food courts serving local, Asian and sometimes international cuisine at affordable prices are commonly found in neighborhoods and shopping malls. There would usually be at least one each of Halal and vegetarian stalls in most establishments. Operating hours of the stalls vary but most of them open by 10am and close by 9pm.

Restaurants and cafes are usually found in shopping malls and bigger neighborhoods. Operating hours depend on the types of meals served but most would be open between 11.00am and 9.00pm.

Most shopping malls in Singapore operate from 11.00am to 10.00pm every day.

BANK SERVICES & FOREIGN EXCHANGE

Participants may use major credit cards to withdraw cash using the Auto Teller Machines, which can be found in various locations on campus. Alternatively, the local banks offer regular banking services including processing foreign exchange and traveler's cheques. The nearest branches are:

DBS (Holland Village Branch)
    Address: 257 Holland Avenue, Singapore 278984
    Operating hours: 8.30am – 4.30pm (Monday – Friday)
                          8.30am - 1.00pm (Saturday)

DBS/POSB (NUS Remix Branch)
    Address: 31 Lower Kent Ridge Road, #01-02 Yusof Ishak House, Singapore 119078
    Operating hours: 8.30 AM - 4.30 PM (Monday to Friday)
                          8.30 AM - 1.00 PM (Saturday)
Only Personal Banking Services are available. Demand Draft and Remittance services are not available. All cash transactions must be made at Automated Teller Machines.

POSB (Buona Vista Branch)
    Address: Blk 43 Holland Drive #01-59, Singapore 270043
    Operating hours: 8.30am – 4.30pm (Monday – Friday)
                          8.30am - 1.00pm (Saturday)

UOB (Holland Village Branch)
    Address: 211 Holland Avenue, #01-12 Holland Road Shopping Centre, Singapore 278967
    Operating hours: 9.30am – 4.00pm (Monday – Friday)
                          9.00am - 12.30pm (Saturday)

PHONES & STAMPS

Public pay phones (cash and card) are available next to the male toilet at the foyer of Lecture Theatre 27 (opposite block S17). Pay phone cards and postage stamps can be purchased at the co-op below Lecture Theatre 27. Other goods and services available at the co-op include books, stationery, sundries and photocopying.

Operating hours (co-op):   9.00am – 6.00pm (Monday – Friday)

The Kent Ridge Post Office at Yusof Ishak House (three bus-stops from LT 27) provides a more comprehensive postal service.

Operating hours: 8.30am – 5.00pm (Monday – Friday)
                                   8.30am – 1.00pm (Saturday)

USEFUL PHONE NUMBERS

Taxi (for current and advanced booking):

Company	Telephone	Colour of vehicle
CityCab	65521111	Yellow
Comfort Taxi	65521111	Blue
Premier Taxis	63636888	Silver
Prime Taxis	67780808	Copper (regular service); Blue (limousine service)
Smart Cab	64857777	Green (regular service); White (supreme service)
SMRT Taxis	65558888	White
Trans Cab	65553333	Red
Yellow Top Taxis	62935545	Yellow top with black body

Local Emergency Services for Credit Cards:

American Express	62991997
Diner's Club Singapore	64160800 (during office hours); 64160800 (after office hours)
MasterCard	800-1100-113
Visa	800 4481 250

Others:

Tourist Information	1800-7362000
24-hour Flight Enquiry (Changi Airport)	1800-5424422
Buona Vista Neighbourhood Police Post	1800-7779999
Police Emergency	999
Non-emergency Ambulance	1777
Fire Engine/Ambulance	995

Zonal Map
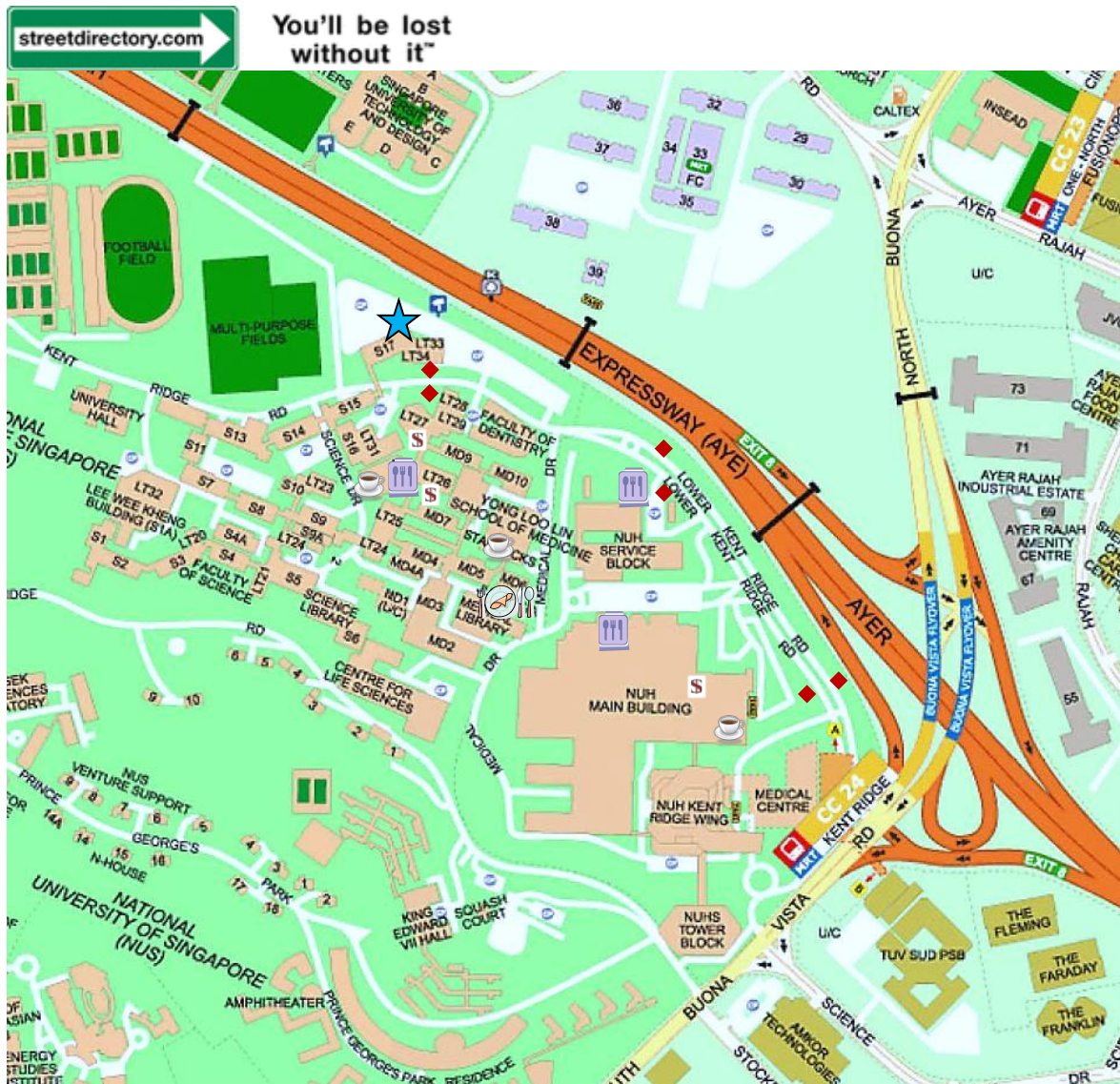
Map powered by Streetdirectory.com

⭐   Workshop venue (S17)

◆   Bus-stop

🍴   Canteen/Food Court

🍽   Restaurant

☕   Coffee joints (Starbucks at School of Medicine; Spinelli at Science canteen; The Coffee Bean at NUH)

$ Auto Teller Machine

Master of Science in Quantitative Finance
(by coursework)

AUG 2014 INTAKE

Offered by Department of Mathematics
with the cooperation of Department of Economics
and Department of Statistics & Applied Probability

OBJECTIVE

To provide advanced training in quantitative finance for the students and to prepare them for rewarding careers in the financial industry that need the effective use of quantitative methods, including derivative pricing, asset and portfolio management, financial modeling and software development, risk management and quantitative trading.

STRUCTURE

40-modular credit program consisting of 6 essential modules and 4 elective modules. Each module is a semester-long course, generally requiring 3 hours of lecture per week for 12 weeks. A full-time student may complete the programme within a minimum period of 1 year (2 regular semesters plus 2 special terms) while a part-time student may complete it in 2 to 4 years.

ELIGIBILITY

Open to candidates from any field with strong background in mathematics, in particular holders of Honours degree (equivalent to 4-year Bachelor's degree in some countries) in mathematics, statistics, physics and engineering.

A candidate whose native tongue or medium of undergraduate instruction is not English must also complete the TOEFL or IELTS or Diagnostic English Test (DET-administered by the NUS Centre for English Language Communication). The minimum acceptable scores are: TOEFL - 580, IELTS - 6, DET - Pass

FEES

- Application fee (non-refundable) is S$20 per online application or S$40 per paper application.
- Tuition fee for the 10-course program (August 2014 intake) is SGD27,000.
- Refer to program website for other fees.

QUERIES

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Tel: +65-65162762
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Apply before 31 January 2014
Visit http://ww1.math.nus.edu.sg/GPMQF.aspx for more details